REMARKS

Claims 1, 11, and 40-54 are currently pending. New Claims 44-54 have been added. Claims 44-53 depend from Claim 1. Claim 54 is a second independent claim that incorporates elements of Claim 1 as well as new Claims 44 and 45. Support for the new claims can be found throughout the specification and original claims, for example, in Claims 1-4 and 12-21, and paragraphs 0115, 0026, and 0129-0136, and Figures 1-4B of the published application. No new matter has been added by these new claims.

Summary Of Argument

Each of the pending claims recites a method of cleaning a CVD chamber which includes opening a valve between a remote plasma chamber and the reaction chamber by "withdrawing a valve body completely from a path to form an opening substantially as wide as internal surfaces of the piping."

The Examiner asserts a combination of references to meet the claim elements but, against clear teachings away from this fully open valve arrangement, supplies no teaching or suggestion of the desirability of the claimed method. (*See In re Gordon*, 733 F.2d 900, 902 (Fed. Cir. 1984)). Instead, the Examiner merely asserts a reference that appears (from schematic figures) to lack a restriction in the relevant location and has no valve.

Applicants acknowledge that valves such as that recited existed at the time of the invention. However, the mere existence of such valves does not amount to obviousness of their use for the claimed method. In fact, because the art as a whole clearly taught away from the claimed method, the Examiner must do more than simply find the isolated elements in the prior art.

The Claimed Method is Non-obvious over Subrahmanyam, Fong, and Smith.

The Examiner has asserted that the pending claims are obvious over Subrahmanyam (6,079,426) in view of Fong (5,812,403) and Smith (6,150,628). The Examiner has asserted that Subrahmanyam teaches a:

> Method of cleaning a CVD chamber comprising establishing a flow of cleaning gas (NF3) through the remote plasma module and the CVD chamber after conducting a CVD reaction and prior to supplying activated plasma species into

> the CVD chamber; dissociating a cleaning gas within the remote plasma module 300 to produce activated plasma species; flowing activated plasma species from the remote plasma module through manifold 380 to the CVD chamber, wherein the flow of plasma species through the manifold 380 is not restricted..." (Office Action, page 2).

The Examiner acknowledges that "Subrahmanyam remains silent about a valve that controls the supply of cleaning gas into the CVD chamber..." (OA, page 3). However, the Examiner has asserted that one, motivated by the teachings in Fong, would have found it obvious to use a valve in order to prevent deposition of residues inside the cleaning manifold of Subrahmanyam. Additionally, the Examiner has asserted that Subrahmanyam would motivate one of skill in the art to maintain a full opening of the manifold "in order to maintain the same full and non-restricted flow of the cleaning gas during the CVD chamber cleaning...". Applicants respectfully traverse the rejection. Applicants respectfully disagree with the Examiner's assessment of the state of the prior art and the actual teachings of Subrahmanyam.

One of skill in the art would not interpret Subrahmanyam as teaching the desirability of a free and unobstructed flow between the remote chamber and the deposition chamber.

First, Applicants note that nowhere in Subrahmanyam is there an actual, implied, or inherent positive teaching that there should be a full and non-restricted flow of a cleaning gas between the two chambers (see entire patent). At best, it simply lacks a positive description of any restriction but does not teach any desirability of this lack of restriction. Indeed, none of the art (including Subrahmanyam) appears to recognize that the particular portion of the piping recited in the present claims (between the two chambers) should be unrestricted or that there could be some benefit gained by keeping this section unrestricted during cleaning.

The only apparent disclosure in Subrahmanyam depicting the remote chamber and the piping appears to be Figure 2 which is not, with respect to the relevant parts (e.g., 300, 380, 395, and 9), a literal depiction of that section of the actual device. Rather, items 300, 380, 395, and 9 are generally depicted symbolically. The fact that the depiction of item 380 is merely a representation and not a literal depiction is demonstrated by the fact that item 380 only depicts one passage through which gas may pass; however, item 380 is a "manifold." The definition of a "manifold" is a "pipe or chamber having multiple apertures for making connections." (American

Heritage Dictionary 2004, emphasis added). Thus, it is clear that item 380 is not meant to be a literal depiction of the structure of the piping. As it is clear that the passage through item 380 is merely demonstrating the concept of a passage and is not teaching the actual passage itself, it should also be clear that item 380, without more, cannot be correctly characterized as affirmatively teaching that a non-restricted or "full" passage between the two chambers would be desirable. Thus, there is no teaching or suggestion that any valve, should one be added, be able to be completely withdrawn from the flow path.

Furthermore, as the Examiner appreciates, the representative depiction in Subrahmanyam is to be interpreted by one of skill in the art, who, as demonstrated by the numerous references discussed in the last section of this Response, would have assumed that the device had the standard components known in the art—unless explicitly noted otherwise in the application. Subrahmanyam is completely silent in regard to the exclusion of additional, standard, elements. Thus, one of skill in the art, looking at the teaching of Figure 2 and the specification, would conclude that other aspects would be present in item 380 to the extent that they are routinely used in such a device (indeed, col. 12, lines 5 and 6 note that the description is merely meant to be "illustrative and not restrictive"). Thus, FIG. 2 of Subrahmanyam, when viewed by one of skill in the art does not actually teach that it is desirable to maintain a free and open passage. At best, it suggests that a standard connection between the two chambers is desirable.

In summary, Subrahmanyam is silent in regard to the actual nature of the passage characteristics between the two chambers. Applicants respectfully note that it is improper to read this absence of a teaching as an affirmative teaching or suggestion of something that was not actually taught or considered in Subrahmanyam. Certainly there is no teaching of the desirability of a fully open passage. ("The mere fact that the prior art could be so modified would not have made the modification obvious unless the prior art suggested the desirability of the modification." Emphasis added, *See, In re Gordon* at 902). Applicants respectfully submit that the general discussion and schematic in Subrahmanyam, when viewed by one of skill in the art, would not motivate one to modify or particularly select the valve in Fong to result in the presently claimed method steps. This is further supported by the references discussing the state of the art in the last section of this Response.

Not every element is taught by the claimed combination.

Neither Fong nor Subrahmanyam nor their proper combination teach that any choice of valve should be fully opened during cleaning in the recited manner of Claim 1. While Fong does teach a valve, the presently claimed method requires a valve that is opened during use "to form an opening substantially as wide as internal surfaces of the piping...." The valve in Fong does not necessarily meet this requirement even if a gate valve were selected. Even if the correct type of valve were selected, the positioning, operation, and size of the valve must be such as to meet the claimed element of being capable of being "completely [withdrawn] from a path to form an opening substantially as wide as internal surfaces of the piping." As these elements have not been taught or suggested (even by Subrahmanyam, as noted above), and the desirability of such an arrangement in the asserted combination is not taught or suggested in the art as a whole, a *prima facie* case of obviousness has not been established. Smith does not teach or overcome the deficiencies regarding the combination of Subrahmanyam and Fong noted above.

The Claimed Method Step has a Particular Advantage When Applied as Claimed.

The recited step of "opening a valve...[by] withdrawing a valve body completely from a path to form an opening substantially as wide as internal surfaces of the piping" in the claimed context is not an arbitrary adjustment to the method. Rather, the use of this step allows one to increase the performance of the device, a desirability not recognized in the art for remote plasma cleaning. For example, some of the advantages are as follows:

> deactivation (recombination) of fluorine active species is reduced, due to reduced collisions with the piping surface and structure within the valve. Accordingly, applying radio frequency power of less than 3,000 W to the remote plasma discharge chamber, high-speed cleaning at over 2 micron/min becomes possible. Furthermore, reduced collisions also minimizes thermal energy generated when fluorine active species is deactivated, thus reducing overheating of the piping and the valve. Heat damage to O-rings and other components, and consequent generation of particles is also reduced or eliminated. The frequency with which damaged parts are replaced thus decreases, and operating costs of the device can be decreased while at the same time increasing productivity of the device.

([**0026**] of the specification). Simply put, the inclusion of the recited step, in combination with the other claimed elements, allows for lower amounts of power to be used in the remote plasma discharge chamber while allowing for high-speed cleaning to become possible. This clearly

results in a superior method. Thus, this step must be given appropriate consideration in determining patentability of the method. Not only does the art fail to recognize such efficiency as an issue for plasma cleaning of a CVD chamber, but as discussed in the following section, the most relevant art previously taught away from methods in which the above step was performed.

The Prior Art Taught Away from the Unobstructed Flow of a Cleaning Gas in Cleaning.

As noted in the previous Responses, the art routinely taught the active step of restricting the flow of a cleaning gas between the remote chamber and the deposition chamber during cleaning, such as with filters or through the choice of valve itself. The fact that this was the standard operating procedure in the art at the time of the invention is noted in the present application (*see, e.g.*, 0009-0011 and 0042 of the present Application). Applicants note that none of the cited art contradicts this statement. As noted above, Subrahmanyam's general disclosure of a representative schematic of a manifold does not teach that the absence of a standard form restriction was desirable.

To further demonstrate that, at the time of filing, one of skill in the art assumed that flow restriction during cleaning was desirable (teaching away from the presently claimed embodiment), Applicants are submitting the following discussion regarding the various references that are representative of the state of the art at the time of filing. These references clearly teach away from a step in which a valve is opened so as to "form an opening substantially as wide as internal surfaces of the piping..."

U.S. Pat. No. 5,788,778 ("Shang, '778") positively teaches the use and desirability of a "flow restrictor" to prevent the free flow of gas between a remote chamber and the deposition chamber (*see, e.g.*, "A flow restrictor 59 is employed in pipe 57. Flow restrictor 59 may be placed anywhere in the path between remote chamber 46 and deposition chamber 10." (col. 4, lines 48-50). Indeed, the type of valve disclosed in Shang, a "needle valve," is explicitly disclosed as useful because it creates a significant pressure differential. (col. 5, lines 22-30). Thus, Shang '778 clearly teaches a method of using a valve, based on a valve's ability to create a pressure differential, while the presently recited method employs a valve with features (withdrawing a valve body completely from a path to form an opening substantially as wide as

internal surfaces of the piping) that accomplish just the opposite, minimizing any pressure differential created when fully opened.

Additionally, many references teach aspects that further restrict the flow of gas, thereby making the use of the recited valve pointless or counterintuitive. For example, a "flow restrictor," which slows down the flow is specifically taught in U.S. Pat. No. 6,274,058. Additionally, Sun et al. (2002/0033183), teaches the use of a "flow restrictor" (0013). Additionally, Shang EP 0697467 teaches that a filter 56 should be placed between the remote chamber 46 and the processing chamber. Applicants note that the use of filters in this location was common and that their use will result in the restriction of the flow of gas, making the presently recited type of valve a pointless selection or modification. Additionally, Fujimura (U.S. Pat. No. 4,718,976), teaches away from the use of the presently recited valves. Applicants note that Fujimura teaches projections 22 with respect to the inner surface of the piping. Furthermore, the "valve" of Fujimura employs a gas diffusing plate 25 that is "fixed in front of the activated gas" (FIGS. 3-5 and col. 3, lines 44-54). As such, it is clear that Fujimura's "valve" cannot be positioned such that it allows an unobstructed flow of cleaning gas. Thus, the skilled artisan will appreciate that Fujimura's valve will naturally cause a significant pressure drop even when fully open. Applicants note that the resultant obstruction of the gas flow was intentional and desired by Fujimura. Fujimura states that "[t]he gas diffusing means... constitutes the most important feature of the present invention...." The gas diffusing means can comprise the diffusing plate 25 (emphasis added, col. 3, lines 42-44). Clearly, Fujimura teaches that the gas should be obstructed by the plate. Applicants note that the use of a diffusing plate teaches away from a desire for low pressure drop. That is, the presently recited valve features have the opposite effect of a diffusing plate in that they do not restrict the flow of the gas. (*See, e.g.*, **0026**).

Thus, it is clear that, at the time of filing of the application, one of skill in the art would not have performed the presently recited step in the claimed combination because the art was focused on slowing, restricting, and controlling the flow in this area, rather than performing a step that minimized pressure differences on either side of the valve. Indeed, the benefits of the recited step are opposite in nature to a step involving a diffusing plate valve or flow restricting valves or filters. The Examiner is respectfully reminded that "a *prima facie* case of obviousness

may also be rebutted by showing that the art, in any material respect, teaches away from the claimed invention." *In re Geisler*, 116 F.3d 1465, 1471, 43 U.S.P.Q.2d 1362, 1366 (Fed. Cir. 1997)" (M.P.E.P. §2144.05 III). Because the art clearly taught that items that obstructed/restricted the flow of gas were desirable, the art taught away from opening a valve by "withdrawing a valve body completely from a path to form an opening substantially as wide as internal surfaces of the piping".

The Examiner is respectfully reminded that disclosures that teach away from the claimed invention must be considered. ("A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention. *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984)" M.P.E.P. §2141.02VI, *see also*, In re Dow Chemical 5 USPQ.2d 1529, 1531-32 (Fed. Cir. 1988)).

As noted above Subrahmanyam does not support the motivation proposed by the Examiner as the diagrams are not meant to depict the actual structure of the piping, and even if it did there is no teaching of the desirability of a completely open piping when a valve is employed. Thus, there is no motivation for why one of skill in the art would have selected or modified a valve so that it could perform the presently claimed element. Moreover, even if a *prima facie* case of obviousness had been established, it would have been rebutted by the fact that the above cited references actually teach away from the proposed combination. Applicants respectfully request that the rejection be withdrawn and the claims allowed.

In addition to the reasons noted above, the dependent claims recite additional elements that further distinguish them over the cited art. For example, Claim 41 recites that the piping is straight, a feature with additional advantages (**0023** and **0026**) that is not disclosed by the cited art (see Fig. 2 of Subrahmanyam and FIG. 1A of Fong). Additionally, Claims 42-54 recite that there is no appreciable pressure loss that arises in the piping and at the valve. This element provides additional advantages to the claimed method (as discussed above) and further distinguishes the claimed invention from the art. As these elements are not taught or suggested by the art, these claims are novel and nonobvious for at least these additional reasons as well.

CONCLUSION

In view of the foregoing amendments and remarks, Applicants respectfully submit that the pending claims are in condition for allowance and request the same. If, however, some issue remains that the Examiner feels can be addressed by Examiner Amendment, the Examiner is cordially invited to call the undersigned for authorization.

Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

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